4.6 Power Amplifiers

The ideal amplifier would deliver 100 percent of the power it draws from the dc powersupply to its load. In practice, 100 percent efficiency cannot be achieved (at this time) because every amplifier uses some percentage of the power it draws from the dc powersupply.

The efficiency of an amplifier is the ratio of ac output power to dc input power, written as a percentage. By formula:

$$\eta = \frac{\text{ac output power}}{\text{dc input power}} \times 100$$

The lower the position of the Q-point on the dc load line, the higher the maximum theoretical efficiency of a given amplifier. Typical Q-point locations for class A, B, AB, and C amplifiers are shown in Figure 11.1 of the text.

The ac load line is a graph of all possible combinations of i_c and v_{ce} for a given amplifier. Under normal circumstances, the ac and dc load lines for a given amplifier are not identical (see Figure 11.3 of the text).

Amplifier Compliance

The compliance (PP) of an amplifier is the limit that the output circuit places on its peak-to-peak output voltage. The compliance for a given amplifier is found using the following equations: $PP = 2I_{CQ}r_C$ and $PP = 2V_{CEQ}$

These equations are developed as illustrated in Figure:

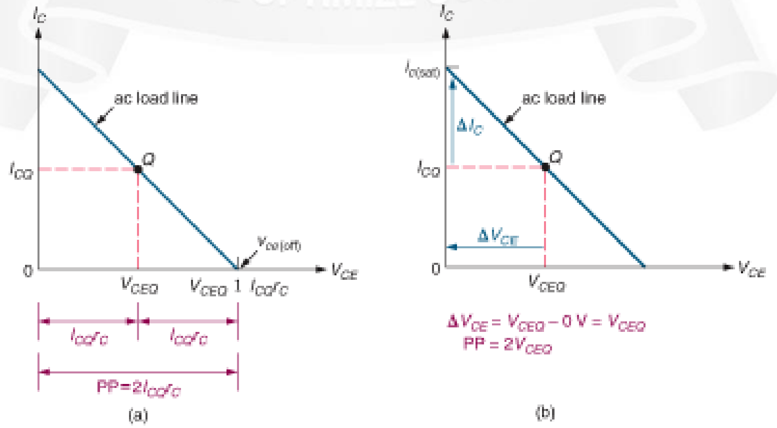

Figure: 4.4.3 Amplifier Compliance

[Source: "Electronic devices and circuits" by "Balbir Kumar, Shail.B.Jain, and Page: 151]

The compliance of an amplifier is determined by solving both PP equations and using the lower of the two results, as demonstrated in Example 11.1 of the text. Note the following:

- When an amplifier has a value of PP = $2V_{CEQ}$, exceeding the value of PP results in saturation clipping.
- When an amplifier has a value of PP = $2I_{CQ}r_C$, exceeding the value of PP results in cutoff clipping. However, the circuit will experience nonlinear distortion before the amplifier peak-to-peak output reaches the value of PP.